TOTSO" 622,260

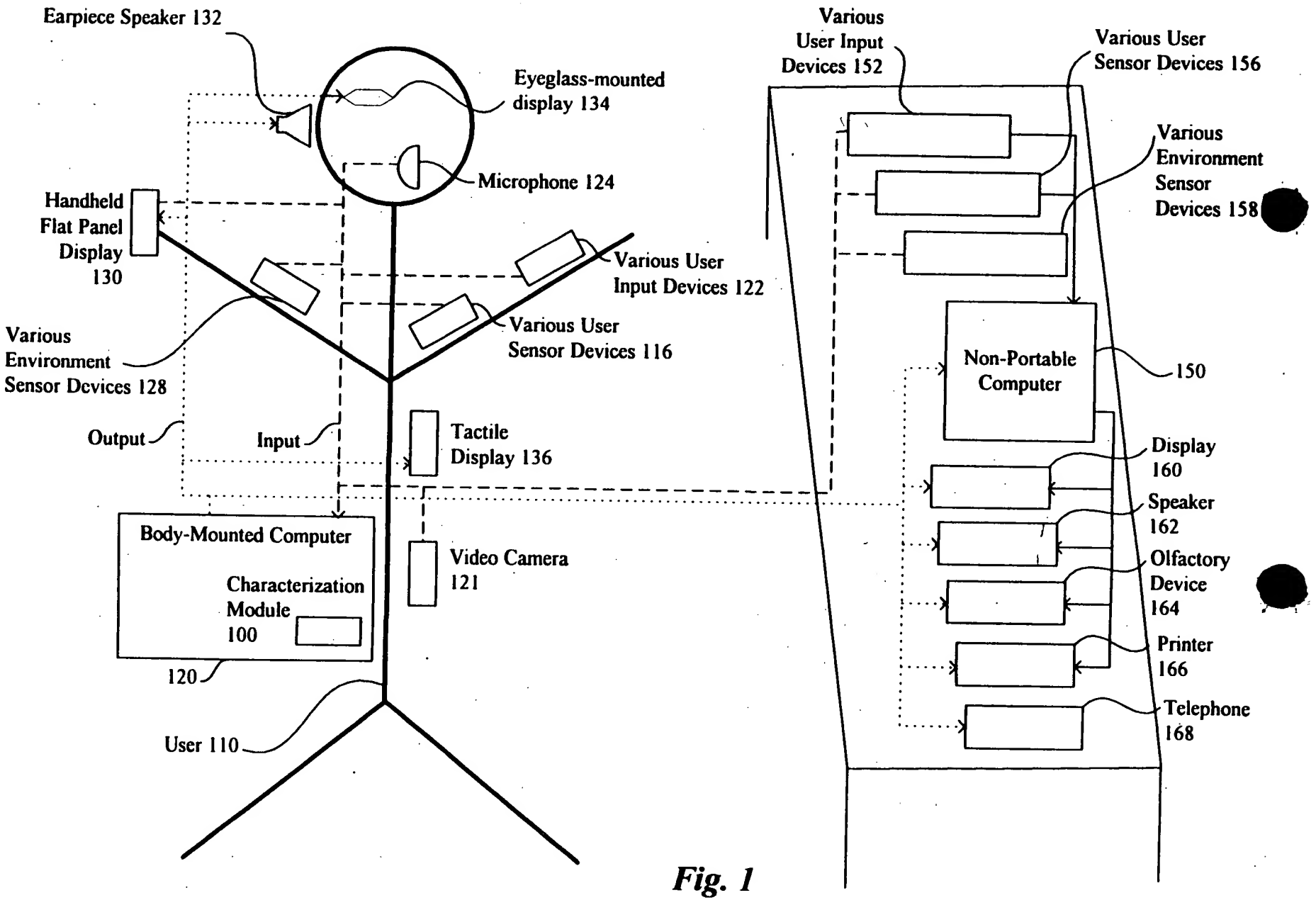


Fig. 1

8005-fig1.vsd

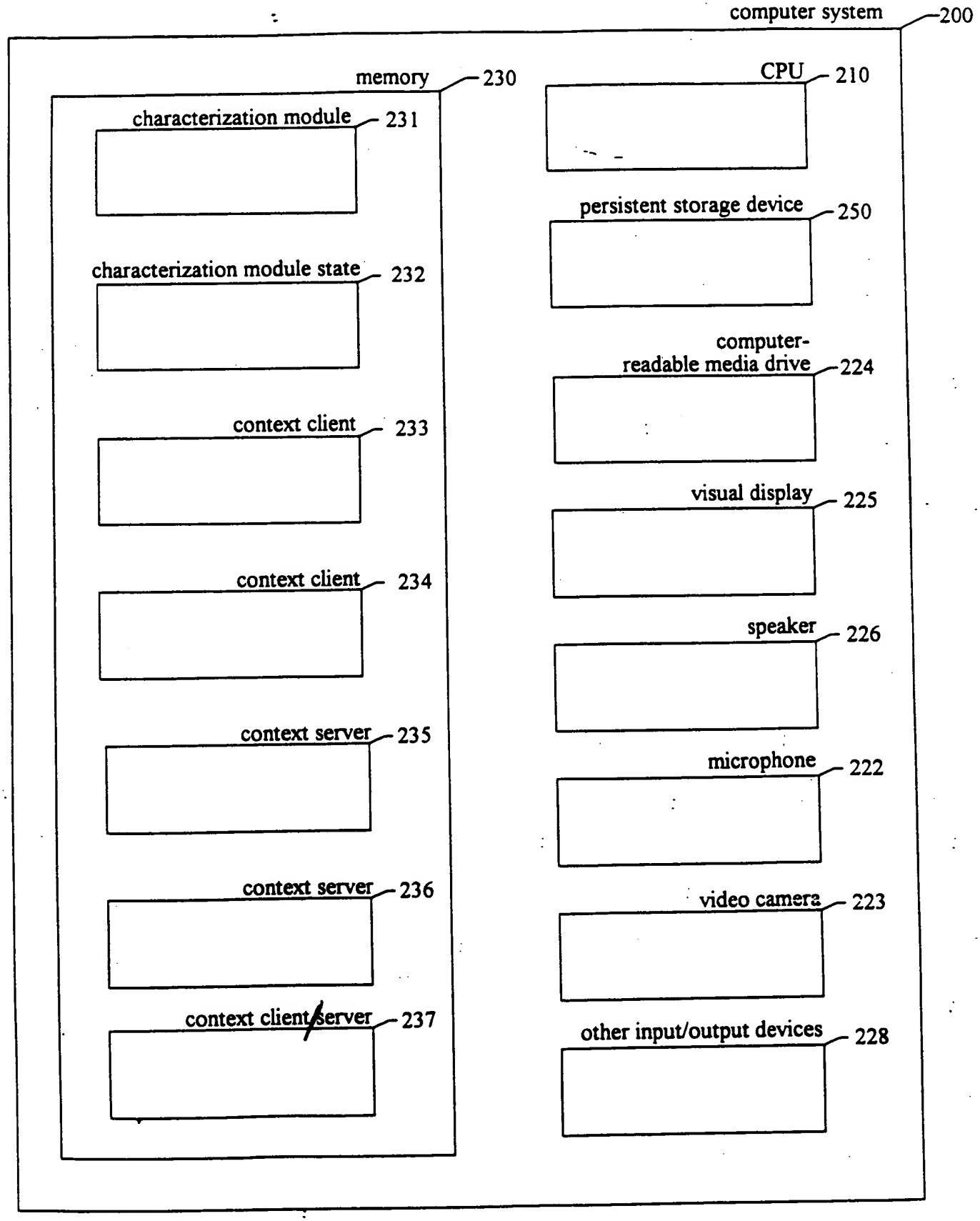


Fig. 2

8005-fig2.vsd

TOTTSO 6EE6Z860

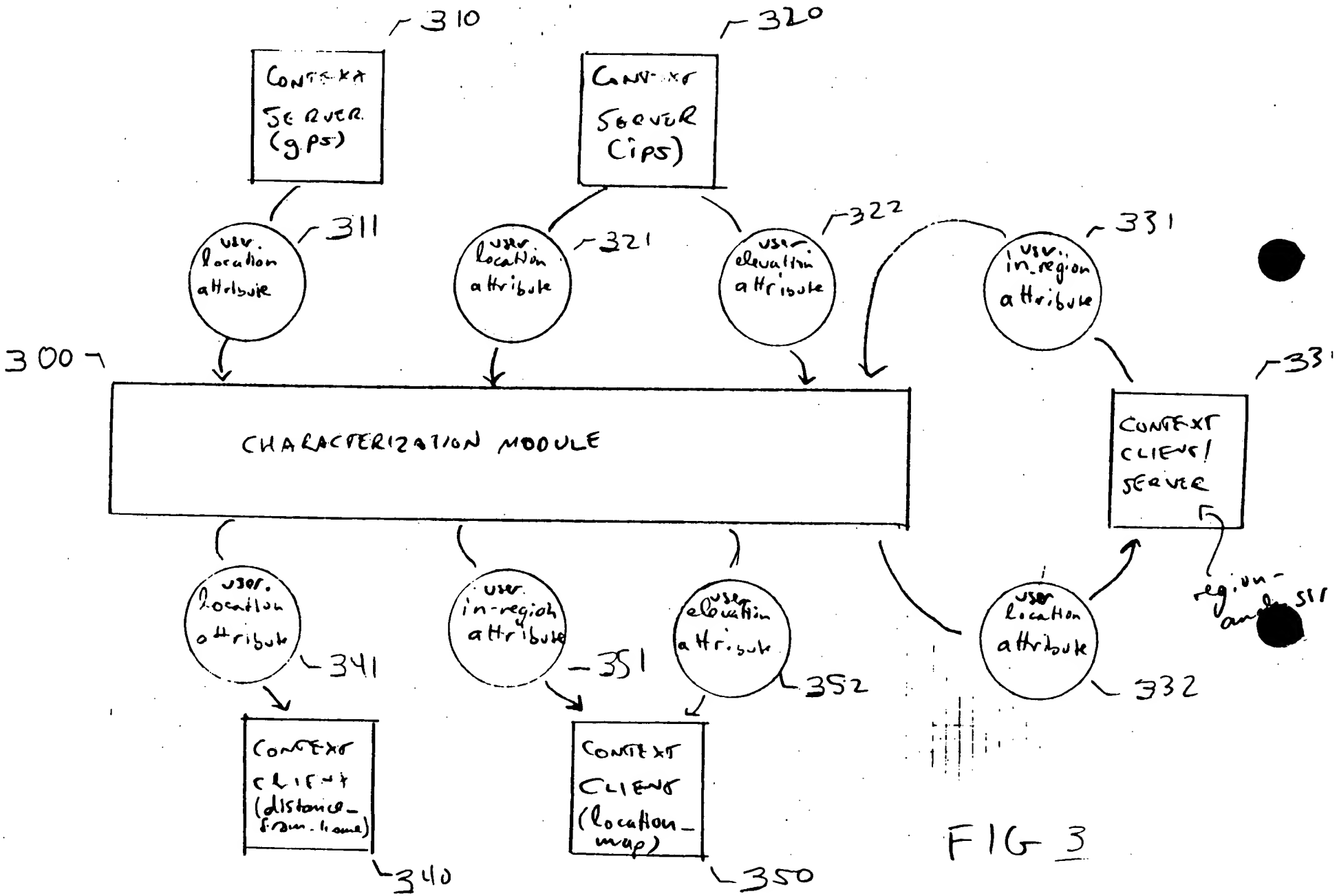


FIG 3

400

context server table

	context server name	version	installation date	filename	request handler
401	gps	1	2/10/2000	gps.exe	(reference)
402	ips	1	2/21/2000	ips.exe	(reference)
403	location_region_analysis	1	2/10/2000	l_r_a.exe	(reference)
	411	412	413	414	415

FIG 4

500

attribute instance table

	attribute name	context server name	value	uncertainty	timestamp	units	number of context clients consuming
501	user.location	gps	47° 38.73' N, 122° 18.43' W	0° .09'	13:11:04.023 2/22/2000	degrees/minutes	2
502	user.location	ips	47° 38.745' N, 122° 18.424' W	0° .021'	13:11:01.118 2/22/2000	degrees/minutes	2
503	user.elevation	ips	22	.5	13:11:01.118 2/22/2000	meters	1
504	user.in_region	location_region_analysis	none	none	none	none	0
	511	512	513	514	515	516	517

FIG 5

context client table 600

context client name	message handler
location_map	(reference)
distance_from_home	(reference)
region_analysis	(reference)

601 602 603

611 612

FIG 6

attribute instance table 700

attribute name	context server name	value	uncertainty	timestamp	units	number of context clients consuming
user.location	gps	47° 38.73' N, 122° 18.43' W	0° .09'	13:11:04.023 2/22/2000	degrees/minutes	2
user.location	ips	47° 38.745' N, 122° 18.424' W	0° .021'	13:11:01.118 2/22/2000	degrees/minutes	2
user.elevation	ips	22	.5	13:11:01.118 2/22/2000	meters	1
user.in_region	location_region_analysis	none	none	none	none	1

701 702 703 704

711 712 713 714 715 716 717

FIG 7

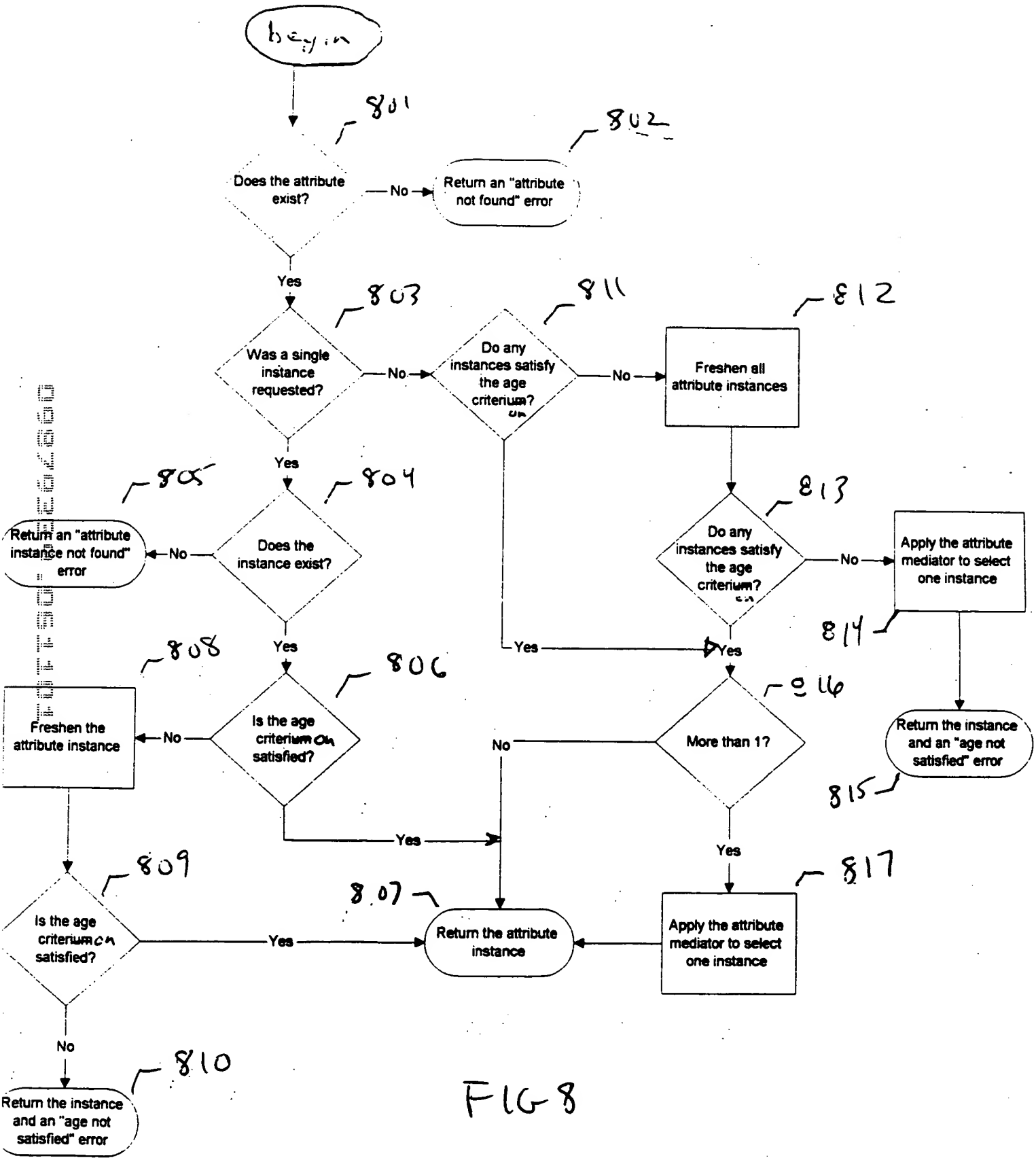

begin
801
Does the attribute exist?
No
802
Return an "attribute not found" error
Yes
803
Was a single instance requested?
No
811
Do any instances satisfy the age criterium?
No
812
Freshen all attribute instances
Yes
805
Return an "attribute instance not found" error
No
804
Does the instance exist?
Yes
813
Do any instances satisfy the age criterium?
No
Apply the attribute mediator to select one instance
814
Yes
Yes
808
Freshen the attribute instance
No
806
Is the age criterium satisfied?
No
816
More than 1?
Return the instance and an "age not satisfied" error
815
Yes
Yes
809
Is the age criterium satisfied?
Yes
807
Return the attribute instance
817
Apply the attribute mediator to select one instance
No
810
Return the instance and an "age not satisfied" error

FIG 8

attribute instance table 900

	attribute name	context server name	value	uncertainty	timestamp	units	number of context clients consuming
901	user.location	gps	47° 38.73' N, 122° 18.43' W	0° .09'	13:11:04.023 2/22/2000	degrees/minutes	2
902	user.location	ips	47° 38.745' N, 122° 18.424' W	0° .021'	13:11:01.118 2/22/2000	degrees/minutes	2
903	user.elevation	ips	22.25	.5	13:11:06.565 2/22/2000	meters	1
904	user.in_region	region_analysis	none	none	none	none	1
	911	912	913	914	915	916	917

FIG 9

condition table 1000

	condition name	context client name	first logical parameter	second logical parameter	comparison value	logical operator
1001	in_region_true	region_analysis	user.in_region	none	TRUE	=
	1011	1012	1013	1014	1015	1016

FIG 10

TOTTSO" 6E26286D

condition monitor table — 1100

condition monitor name	context client name	condition name	behavior	frequency	condition last evaluated	trigger handler reference	stopped
region_boundary_crossed	region_analysis	in_region_true	TRUE or FALSE	30	13:11:29.101 2/22/2000	(reference)	no

1101 — 1111 — 1112 — 1113 — 1114 — 1115 — 1116 — 1117 — 1118

FIG 11

condition monitor table — 1200

condition monitor name	context client name	condition name	behavior	frequency	condition last evaluated	trigger handler reference	stopped
region_boundary_crossed	region_analysis	in_region_true	TRUE or FALSE	30	13:11:59.101 2/22/2000	(reference)	yes

1201 — 1211 — 1212 — 1213 — 1214 — 1215 — 1216 — 1217 — 1218

FIG 12

TOP30 6226860

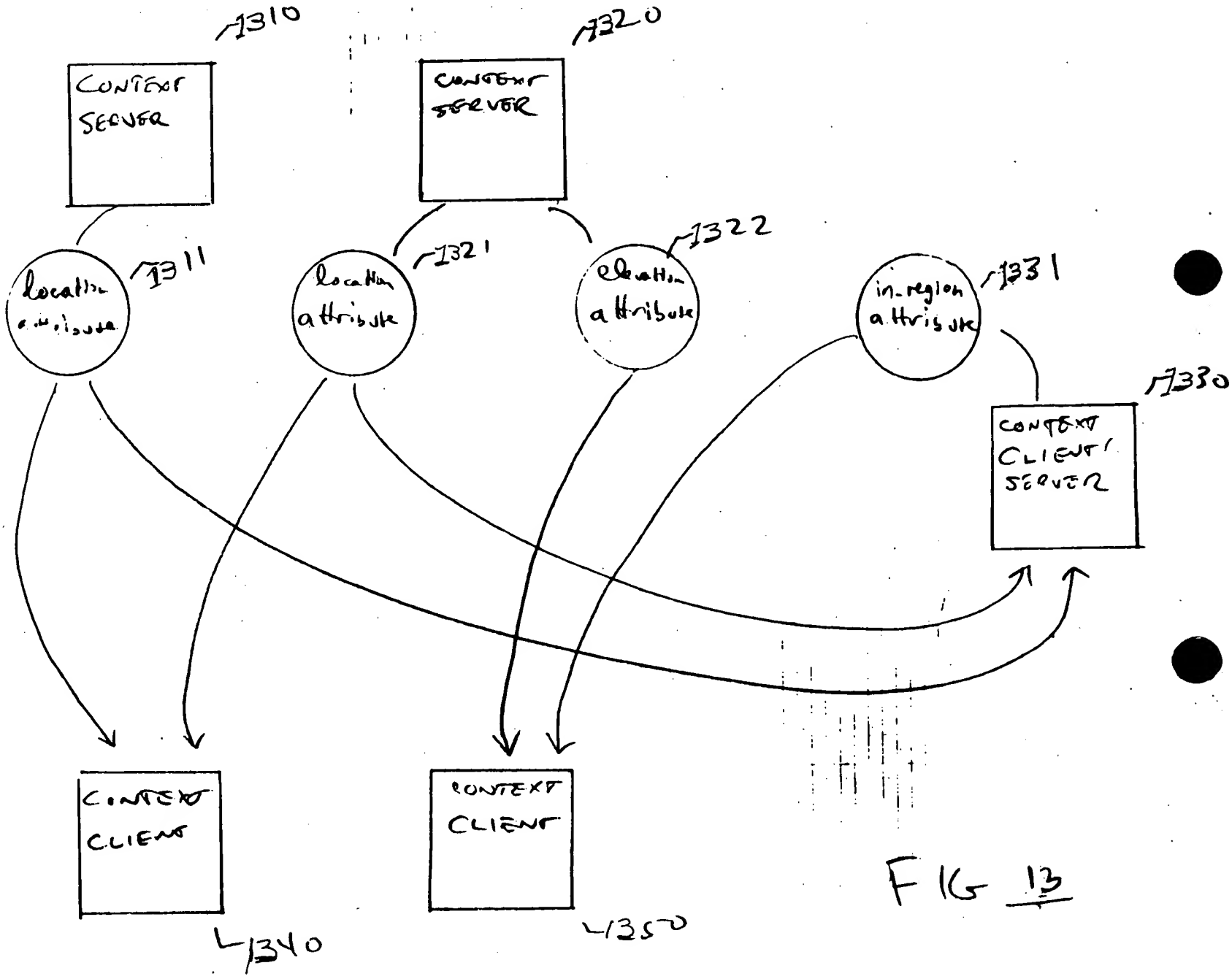


FIG 13

attribute request table

	attribute name	context client name
1401	user.location	distance_from_home
1402	user.in_region	location_map
1403	user.location [gps]	location_region_analysis
1404	user.elevation	location_map

1411 1412

Figure 14

User.
- Desired_privacy_level
- Interruptibility
- Speed
- Direction
- Acceleration
- Availability.
  - Cognitive_availability
  - Tactile_availability
  - Manual_availability
  - Visual_availability
  - Oral_availability
  - Auditory_availability
- Proximity.<Item or place name>
- Mood.
  - Happiness
  - Sadness
  - Anger
  - Frustration
  - Confusion
- Activity.
  - Driving
  - Eating
  - Running
  - Sleeping
  - Talking
  - Typing
  - Walking
- Location.
  - Place_name
  - Latitude
  - Longitude
  - Altitude
  - Room
  - Floor
  - Building
  - Address
  - Street
  - City
  - County
  - State
  - Country
  - Postal_Code
- Destination. (same as User.Location.)
- Physiology.
  - Pulse
  - Body_temperature
  - Blood_pressure
  - Respiration

Person.<name or ID>. (same as User.)

Platform.
- UI.
  - Oral_input_device_availability
  - Manual_input_device_availability
  - Tactile_output_device_availability
  - Visual_output_device_availability
  - Auditory_output_device_availability

Platform. (continued)
- CPU.
  - Load
  - Speed
- Memory.
  - Total_capacity
  - Used
- Storage.
  - Total_capacity
  - Used
- Connectivity.
  - Connection_status
  - Connection_speed
  - Connection_type/device
  - Connection_activity
- Power.
  - Power_source
  - Power_level

Environment.
- People.
  - Nearest
  - Number_present
  - Number_close
- Local.
  - Time
  - Date
  - Temperature
  - Pressure
  - Wind_speed
  - Wind_direction
  - Absolute_humidity
  - High_forecast_temperature
  - Low_forecast_temperature
  - People_present
  - Ambient_noise_level
  - Ambient_light_level
  - Days.<previous or future>.
    - High_temperature
    - Low_temperature
    - Precipitation_type
    - Precipitation_amount
- Place.<place name>. (same as Environment.Local)

Application.
- Mail.
  - Available
  - New_messages_waiting
  - Messages_waiting_to_be_sent
- Phone.
  - Available
  - In_use
  - On/off
  - Notification_mechanism
  - Call_incoming
  - Caller_ID
- Sound_recorder.
  - Available
  - Recording

Fig. 15

1) User Setting
   a) Mental Context
      i) Meaning
      ii) Cognition
         (1) Divided User Attention
         (2) Task Switching
         (3) Background Awareness
      iii) Solitude
      iv) Privacy
         (1) Desired Privacy
         (2) Perceived Privacy
      v) Social Context
      vi) Affect
   b) Physical Situation
      i) Body
         (1) Biometrics
         (2) Posture
         (3) Motion
         (4) Physical Encumberment
            (a) Senses
               (i) Eyes
               (ii) Ears
               (iii) Tactile
               (iv) Hands
               (v) Nose
               (vi) Tongue
            (b) Workload demands/effects
            (c) Interaction with computer devices
            (d) Interaction with people
            (e) Physical Health
      ii) Environment
         (1) Time/Space
         (2) Objects
         (3) Persons
            (a) Audience/Privacy Availability
               (i) Scope of Disclosure
               (ii) Hardware affinity for privacy
               (iii) Privacy Indicator for User
               (iv) Privacy Indicator for Public
               (v) Watching Indicator
               (vi) Being Observed Indicator
         (4) Ambient Interference
            (a) Visual
            (b) Audio
            (c) Tactile

2) Computer
   a) Power
   b) Configuration
      i) User Input Systems
         (1) Hand/Haptic
            (a) Keyboard/Keystrokes
         (2) Voice/Audio
         (3) Eye Tracking
         (4) Cursors
            (a) Axis
            (b) Resolution
               (i) Selection
               (ii) Invocation
            (c) Accelerators
      ii) Output Systems
         (1) Visual
            (a) Resolution
         (2) Audio
            (a) Public/Private
         (3) Haptic
      iii) External Resources
         (1) I/O devices
         (2) Connectivity
   c) Data
      i) Quantity/State
      ii) Urgency/Importance
         (1) Use of Prominence
      iii) Modality
      iv) Sensitivity/Purpose
         (1) Privacy Issues
         (2) Use of Association
         (3) Use of Safety
      v) Source/Ownership
         (1) Types
            (a) User generated
            (b) Other computers or people
            (c) Sensor
            (d) PC State
         (2) Use of Association

Fig. 16

Fig. 17

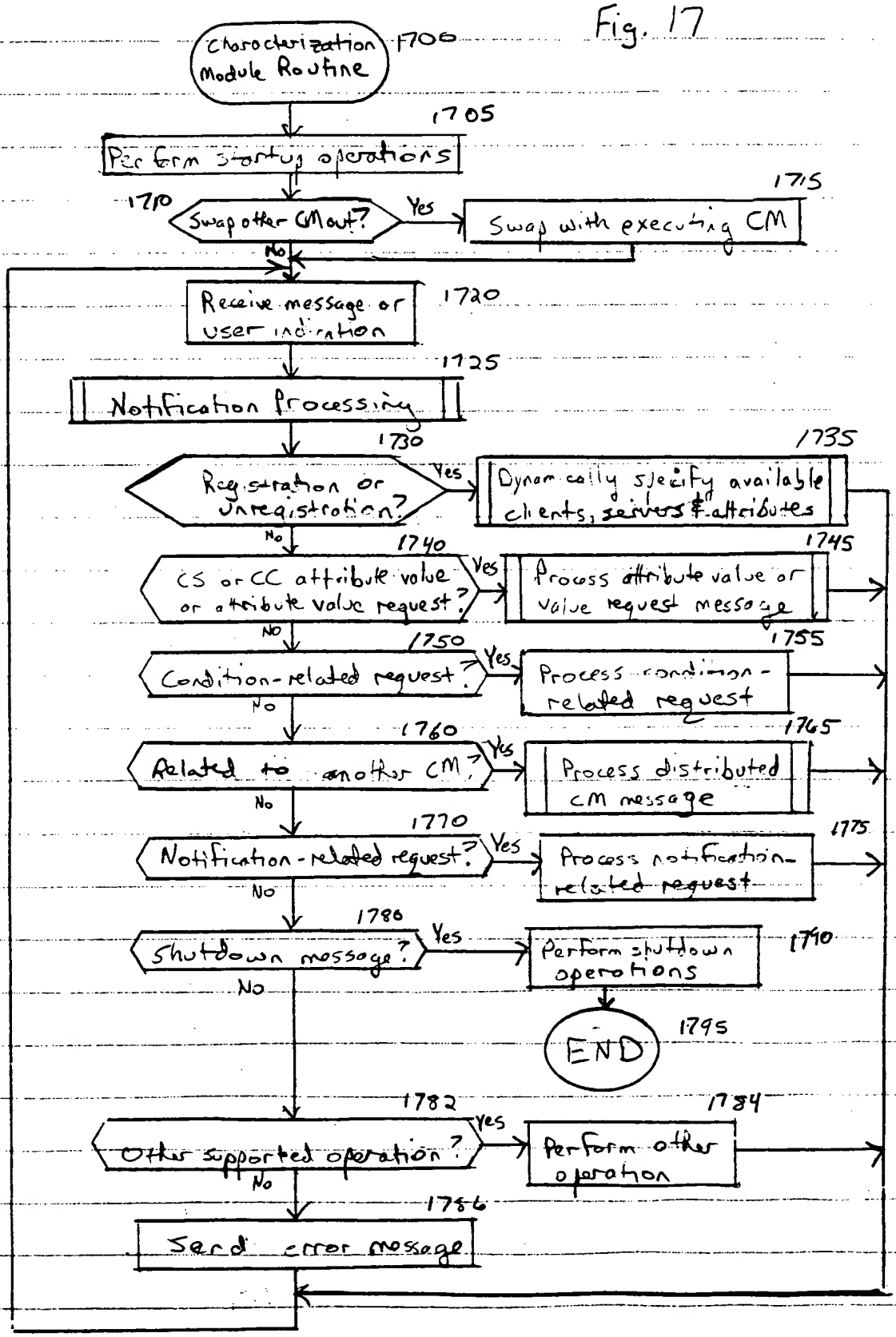

Characterization Module Routine
1700
1705
Perform startup operations
1710
Swap other CM out?
Yes
1715
Swap with executing CM
No
Receive message or user indication
1720
1725
Notification Processing
1730
Registration or unregistration?
Yes
1735
Dynamically specify available clients, servers & attributes
No
1740
CS or CC attribute value or attribute value request?
Yes
1745
Process attribute value or value request message
No
1750
Condition-related request?
Yes
1755
Process condition-related request
No
1760
Related to another CM?
Yes
1765
Process distributed CM message
No
1770
Notification-related request?
Yes
1775
Process notification-related request
No
1780
Shutdown message?
Yes
1790
Perform shutdown operations
No
END
1795
1782
Other supported operation?
Yes
1784
Perform other operation
No
1786
Send error message

Fig. 18

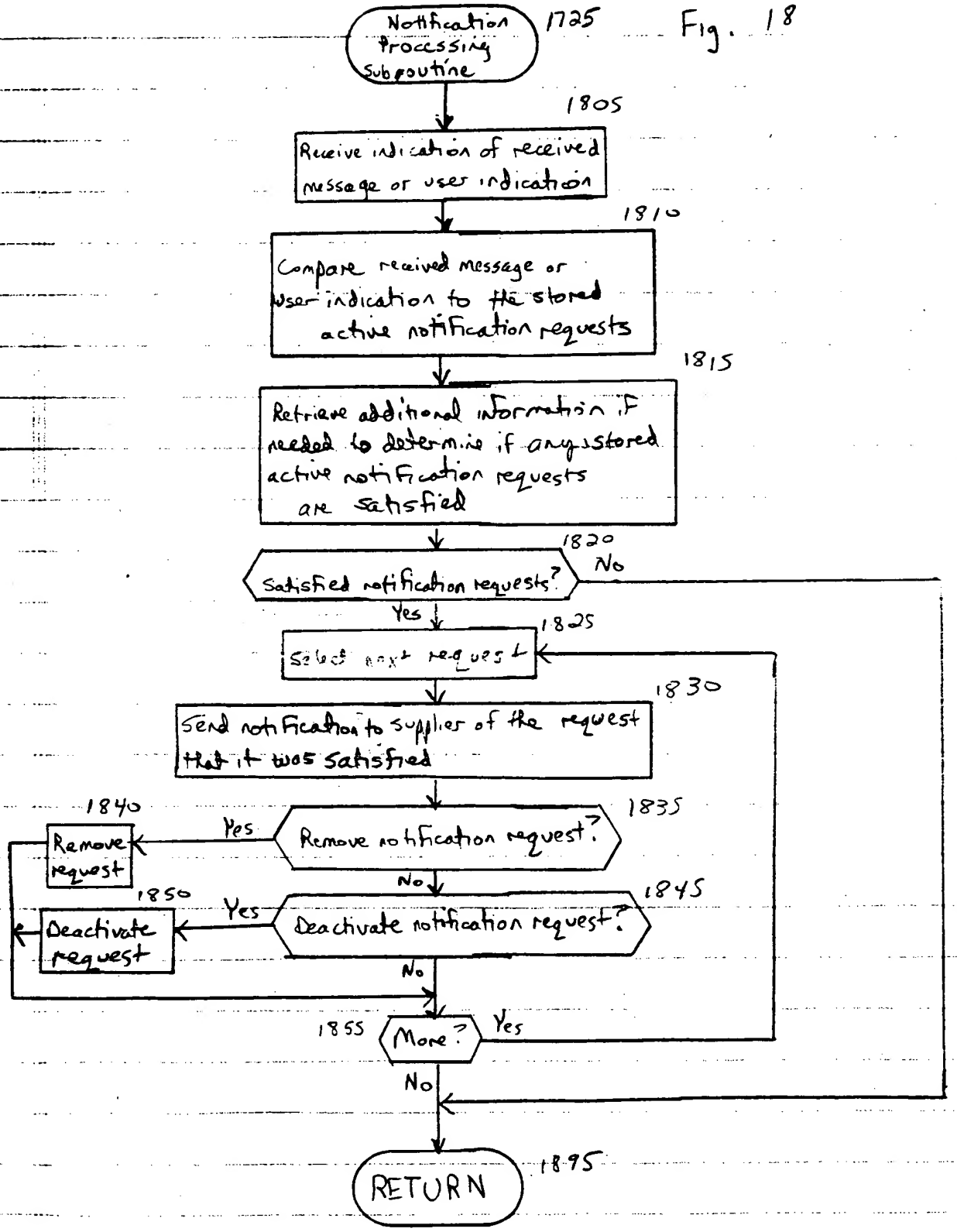
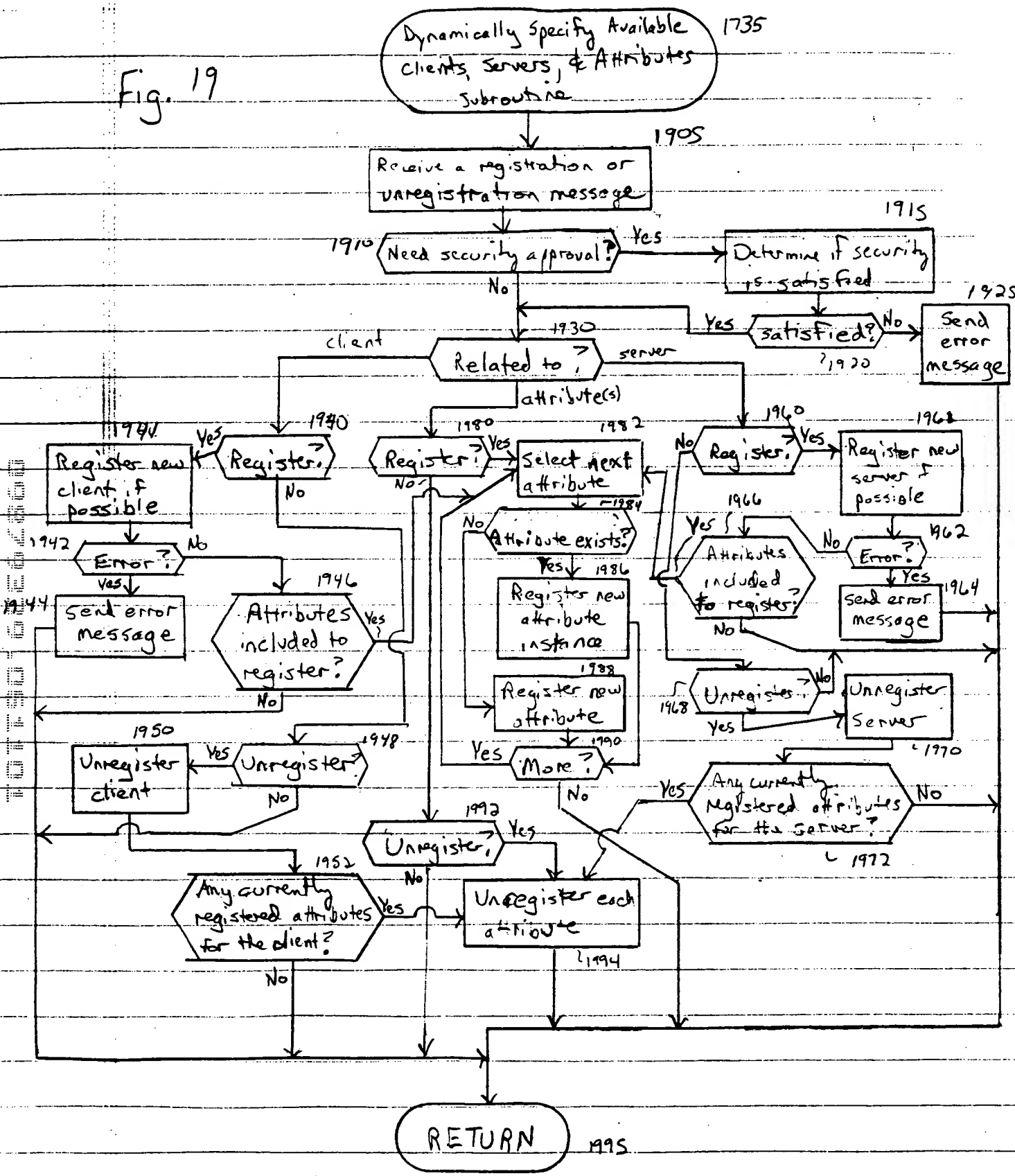
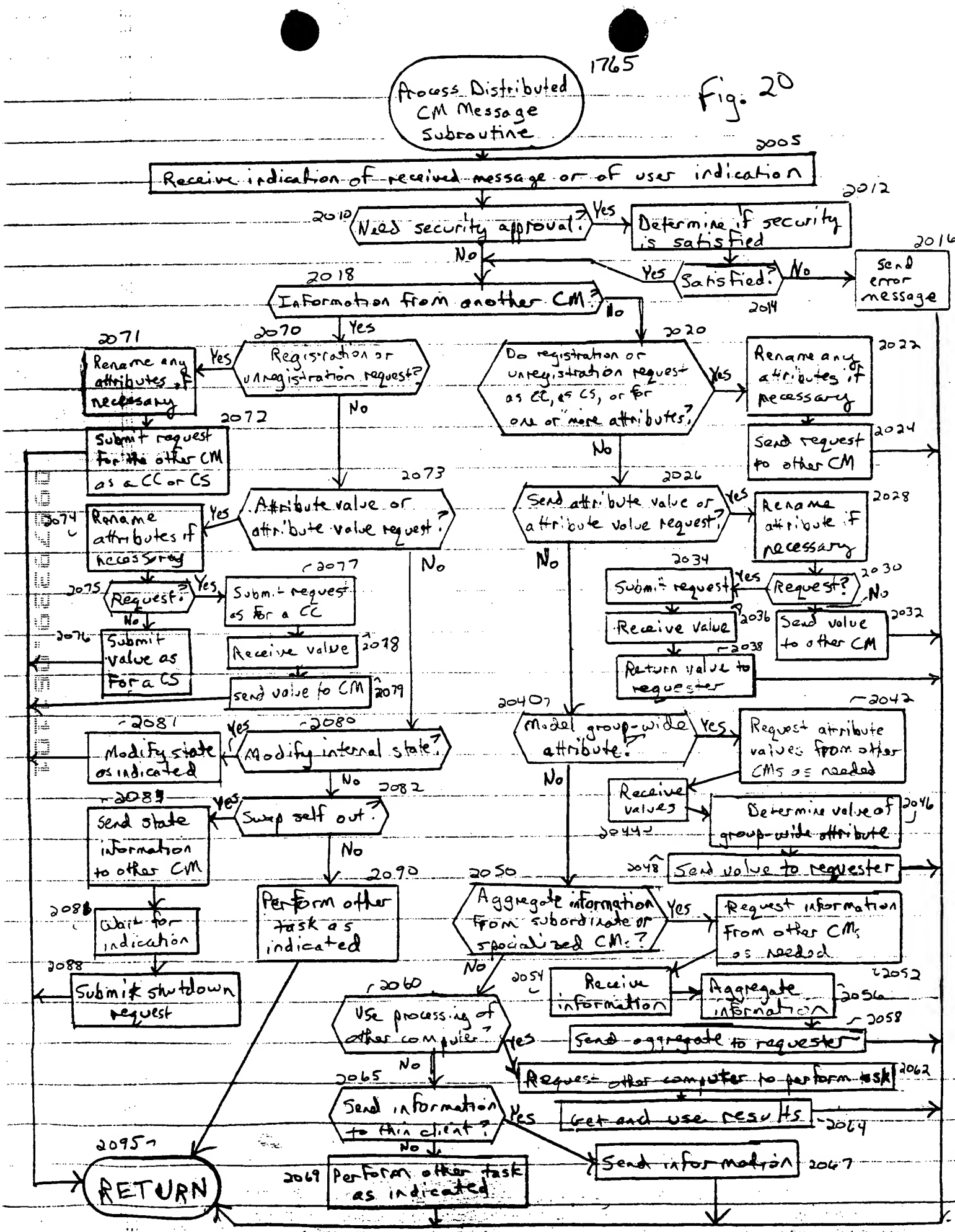
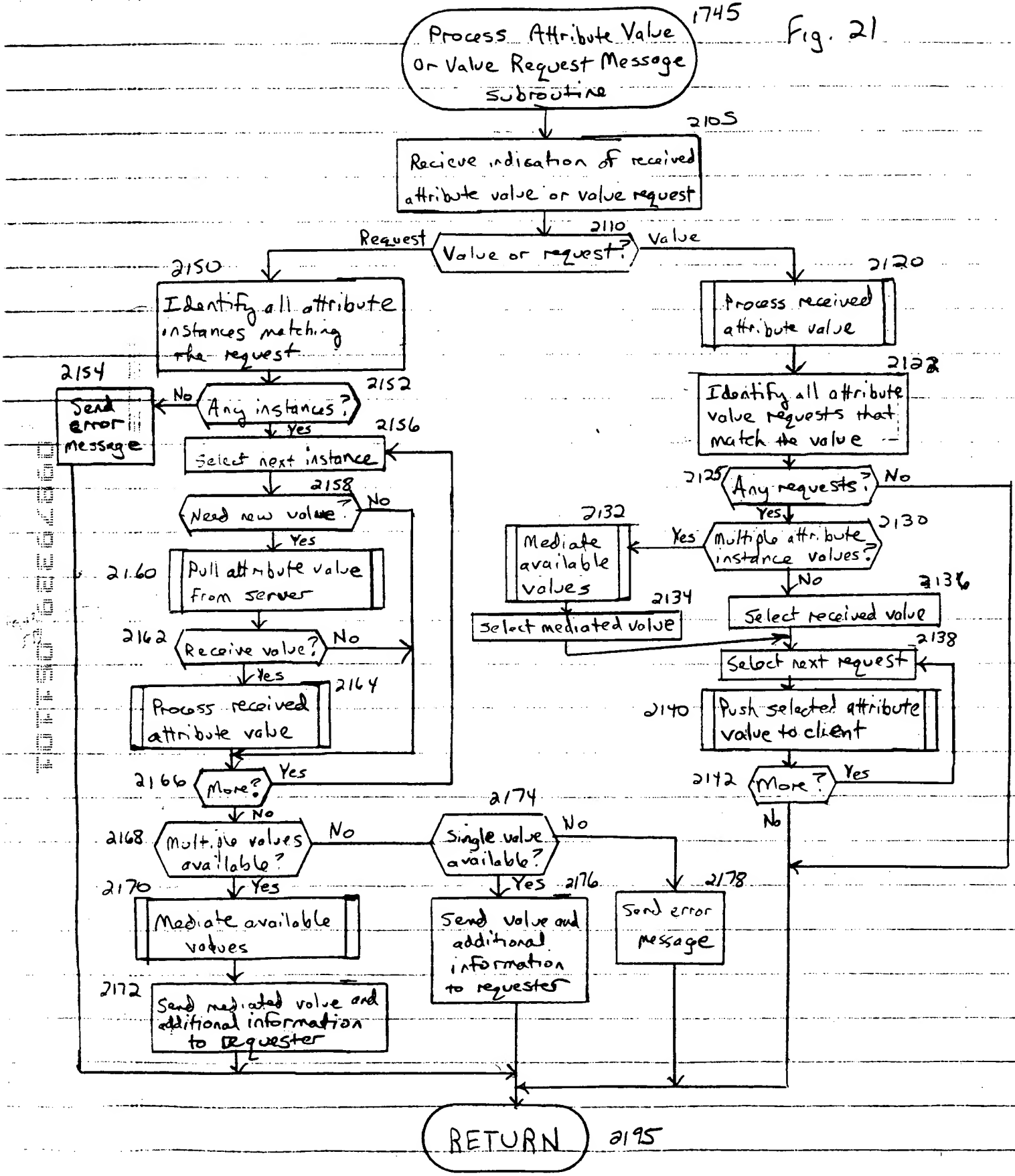

Notification Processing Subroutine
1725
1805
Receive indication of received message or user indication
1810
Compare received message or user indication to the stored active notification requests
1815
Retrieve additional information if needed to determine if any stored active notification requests are satisfied
1820
Satisfied notification requests?
No
Yes
1825
Select next request
1830
Send notification to supplier of the request that it was satisfied
1835
Remove notification request?
Yes
1840
Remove request
No
1845
Deactivate notification request?
Yes
1850
Deactivate request
No
1855
More?
Yes
No
RETURN
1895

Fig. 19


Dynamically Specify Available Clients, Servers, & Attributes Subroutine
1735
1905
Receive a registration or unregistration message
1910
Need security approval?
Yes
No
1915
Determine if security is satisfied
1920
Satisfied?
No
Yes
1925
Send error message
1930
Related to ?
client
server
attribute(s)
1940
Register?
Yes
No
1944
Register new client, if possible
1942
Error?
Yes
No
1944
Send error message
1946
Attributes included to register?
Yes
No
1948
Unregister?
Yes
No
1950
Unregister client
1952
Any currently registered attributes for the client?
Yes
No
1980
Register?
Yes
No
1982
Select next attribute
1984
Attribute exists?
No
Yes
1986
Register new attribute instance
1988
Register new attribute
1990
More?
Yes
No
1992
Unregister?
Yes
No
1994
Unregister each attribute
1960
Register?
No
Yes
1962
Error?
Yes
No
1964
Send error message
1966
Attributes included to register?
Yes
No
1968
Register new server if possible
1968
Unregister?
Yes
No
1970
Unregister Server
1972
Any currently registered attributes for the server?
Yes
No
RETURN
1995


1765
Fig. 20
Process Distributed CM Message Subroutine
2005
Receive indication of received message or of user indication
2010
Need security approval?
Yes
2012
Determine if security is satisfied
Satisfied?
No
2014
2016
Send error message
No
2018
Information from another CM?
Yes
2070
Registration or unregistration request?
Yes
2071
Rename any attributes if necessary
2072
Submit request for the other CM as a CC or CS
No
2073
Attribute value or attribute value request?
Yes
2074
Rename attributes if necessary
2075
Request?
Yes
2077
Submit request as for a CC
2078
Receive value
2079
Send value to CM
No
2076
Submit value as for a CS
No
2080
Modify internal state?
Yes
2081
Modify state as indicated
No
2082
Swap self out?
Yes
2084
Send state information to other CM
2086
Wait for indication
2088
Submit shutdown request
No
2090
Perform other task as indicated
2020
Do registration or unregistration request as CC, as CS, or for one or more attributes?
Yes
2022
Rename any attributes if necessary
2024
Send request to other CM
No
2026
Send attribute value or attribute value request?
Yes
2028
Rename attribute if necessary
2030
Request?
Yes
2034
Submit request
2036
Receive value
2038
Return value to requester
No
2032
Send value to other CM
No
2040
Model group-wide attribute?
Yes
2042
Request attribute values from other CMs as needed
2044
Receive values
2046
Determine value of group-wide attribute
2048
Send value to requester
No
2050
Aggregate information from subordinate or specialized CM?
Yes
2052
Request information from other CMs as needed
2054
Receive information
2056
Aggregate information
2058
Send aggregate to requester
No
2060
Use processing of other computer?
Yes
2062
Request other computer to perform task
2064
Get and use results
No
2065
Send information to this client?
Yes
2067
Send information
No
2069
Perform other task as indicated
2095
RETURN


Process Attribute Value or Value Request Message Subroutine
1745
Fig. 21
2105
Recieve indication of received attribute value or value request
2110
Value or request?
Request
Value
2150
Identify all attribute instances matching the request
2154
Send error message
No
2152
Any instances?
Yes
2156
Select next instance
2158
Need new value?
No
Yes
2160
Pull attribute value from server
2162
Receive value?
No
Yes
2164
Process received attribute value
2166
More?
Yes
No
2168
Multiple values available?
No
2170
Yes
Mediate available values
2172
Send mediated value and additional information to requester
2174
Single value available?
No
Yes
2176
Send value and additional information to requester
2178
Send error message
2120
Process received attribute value
2122
Identify all attribute value requests that match the value
2125
Any requests?
No
Yes
2130
Multiple attribute instance values?
Yes
2132
Mediate available values
2134
Select mediated value
No
2136
Select received value
2138
Select next request
2140
Push selected attribute value to client
2142
More?
Yes
No
RETURN
2195

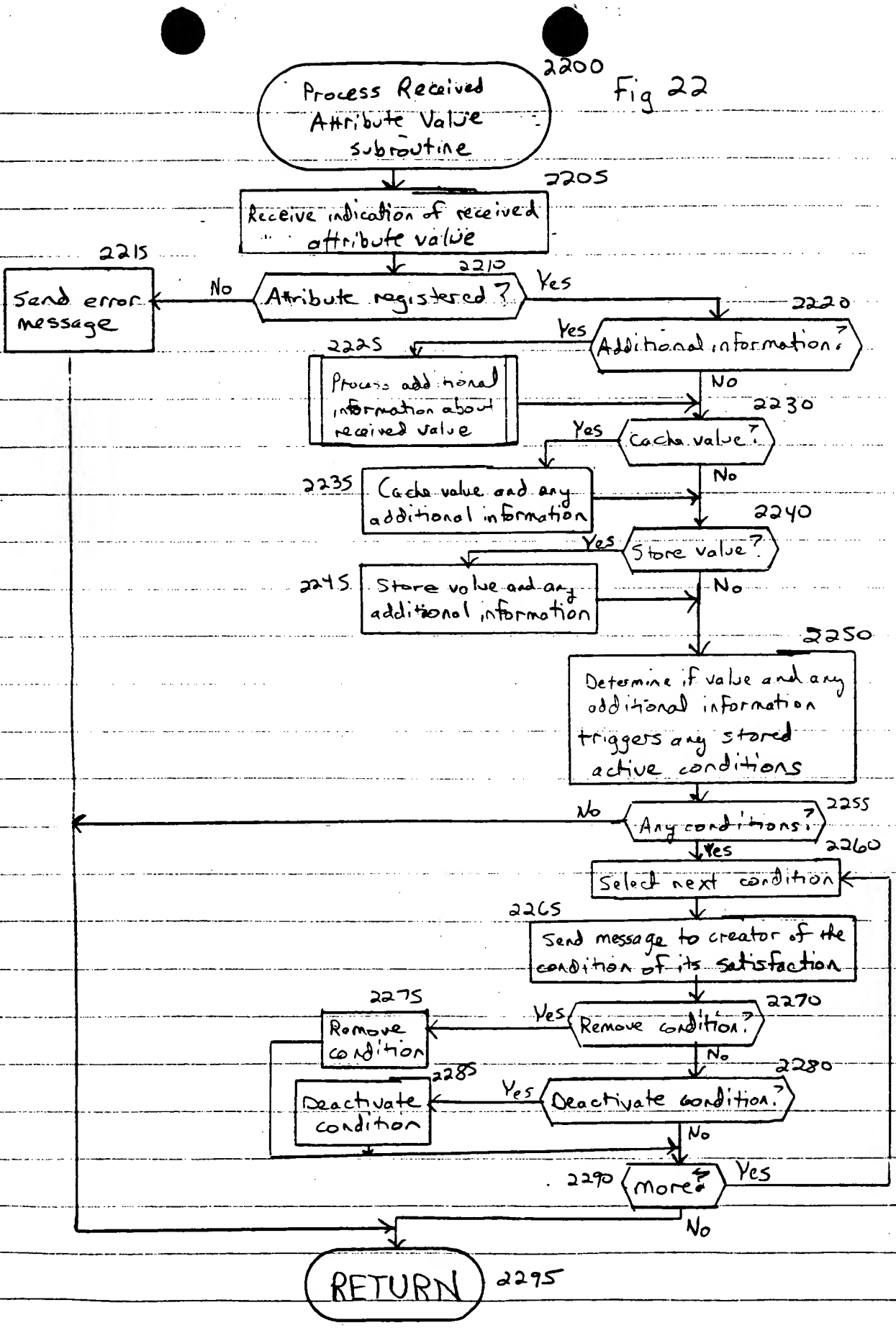

2200
Process Received Attribute Value subroutine
2205
Receive indication of received attribute value
2210
Attribute registered?
No
2215
Send error message
Yes
2220
Additional information?
Yes
2225
Process additional information about received value
No
2230
Cache value?
Yes
2235
Cache value and any additional information
No
2240
Store value?
Yes
2245
Store value and any additional information
No
2250
Determine if value and any additional information triggers any stored active conditions
2255
Any conditions?
No
Yes
2260
Select next condition
2265
Send message to creator of the condition of its satisfaction
2270
Remove condition?
Yes
2275
Remove condition
No
2280
Deactivate condition?
Yes
2285
Deactivate condition
No
2290
More?
Yes
No
RETURN
2295

Fig 22

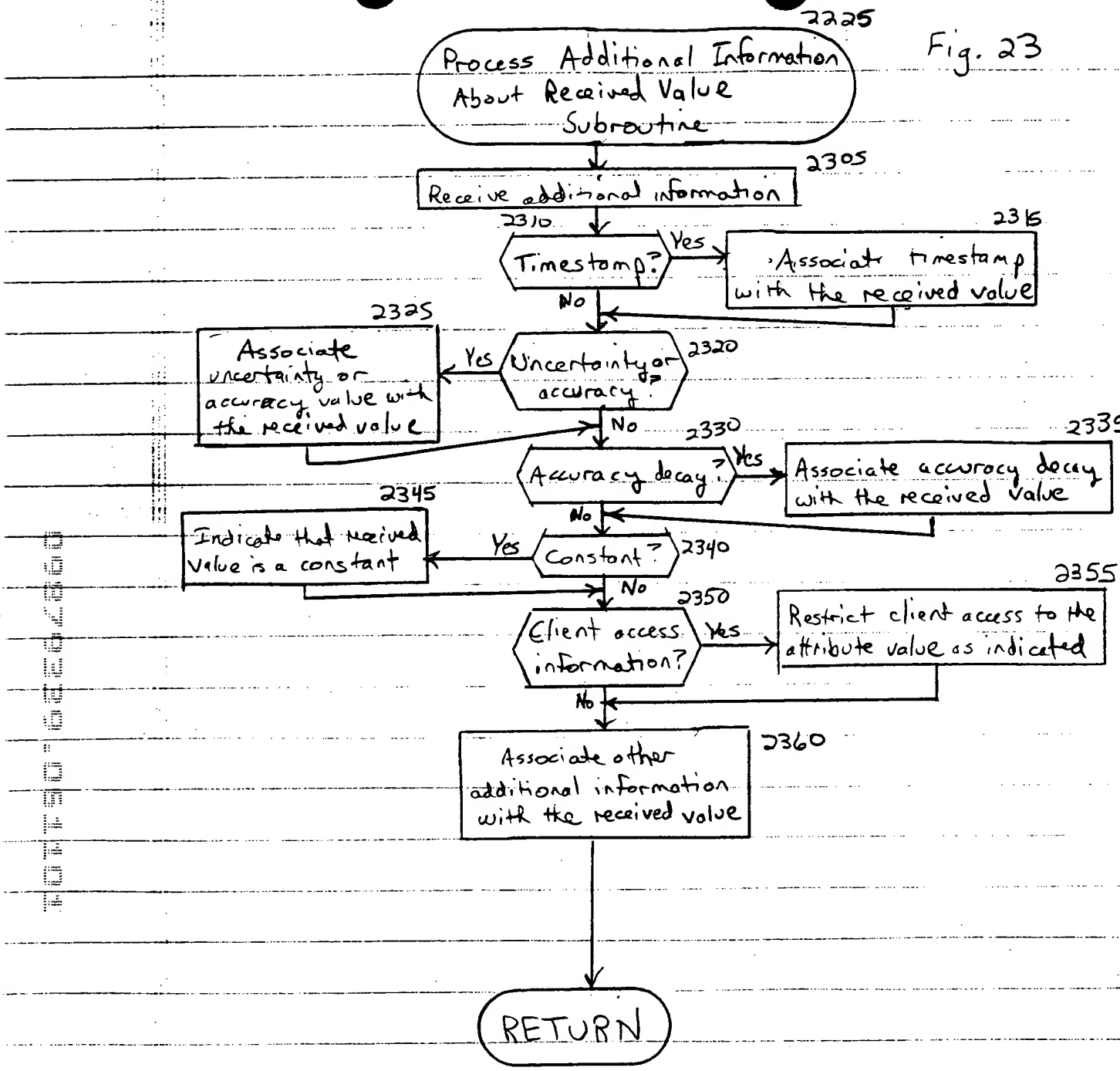
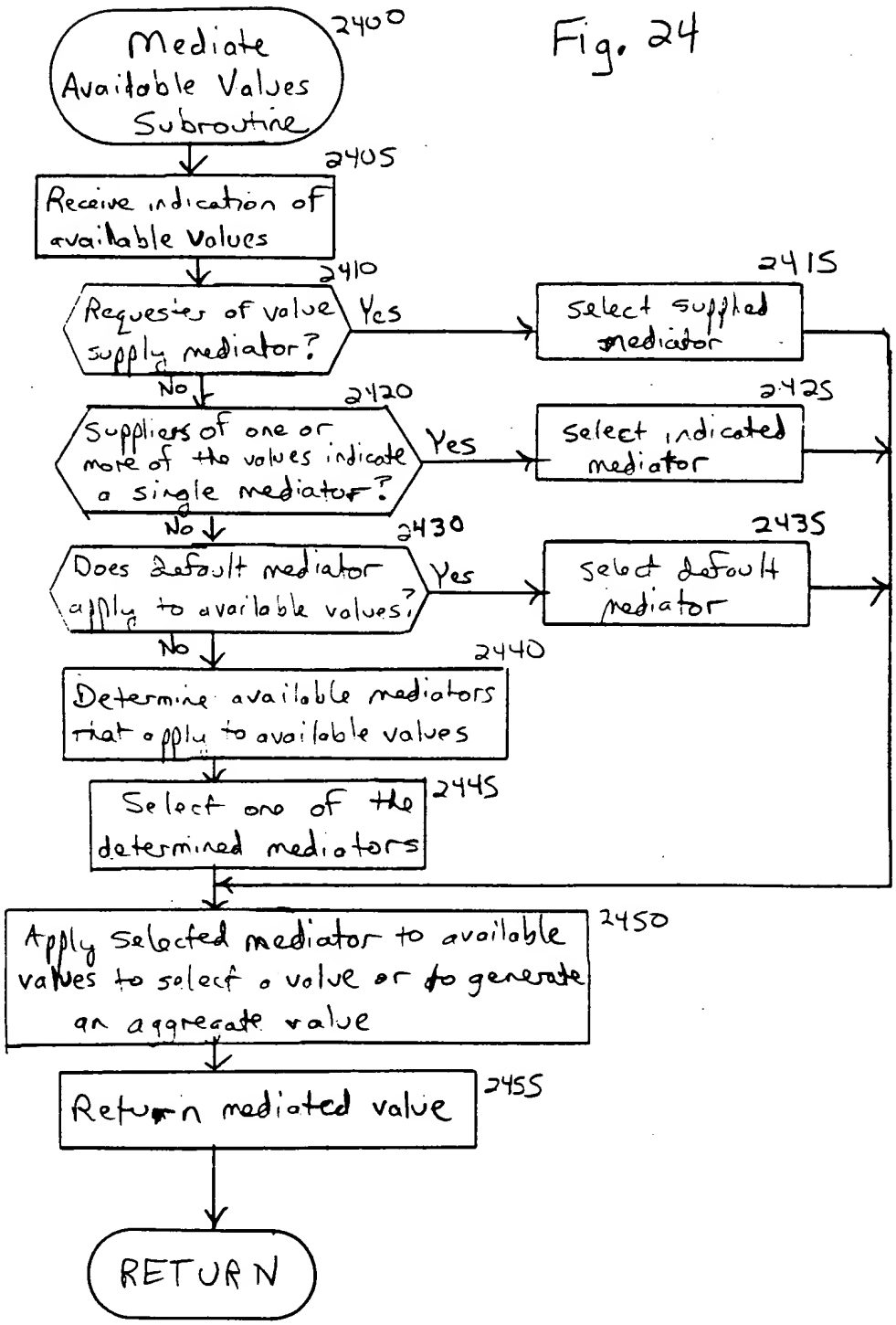

2225
Process Additional Information About Received Value Subroutine
2305
Receive additional information
2310
Timestamp?
Yes
2315
Associate timestamp with the received value
No
2325
Associate uncertainty or accuracy value with the received value
Yes
Uncertainty or accuracy?
2320
No
2330
Accuracy decay?
Yes
2335
Associate accuracy decay with the received value
No
2345
Indicate that received value is a constant
Yes
Constant?
2340
No
2350
Client access information?
Yes
2355
Restrict client access to the attribute value as indicated
No
Associate other additional information with the received value
2360
RETURN

Fig. 23

Fig. 24


Mediate Available Values Subroutine
2400
Receive indication of available values
2405
Requestor of value supply mediator?
2410
Yes
Select supplied mediator
2415
No
Suppliers of one or more of the values indicate a single mediator?
2420
Yes
Select indicated mediator
2425
No
Does default mediator apply to available values?
2430
Yes
Select default mediator
2435
No
Determine available mediators that apply to available values
2440
Select one of the determined mediators
2445
Apply selected mediator to available values to select a value or to generate an aggregate value
2450
Return mediated value
2455
RETURN

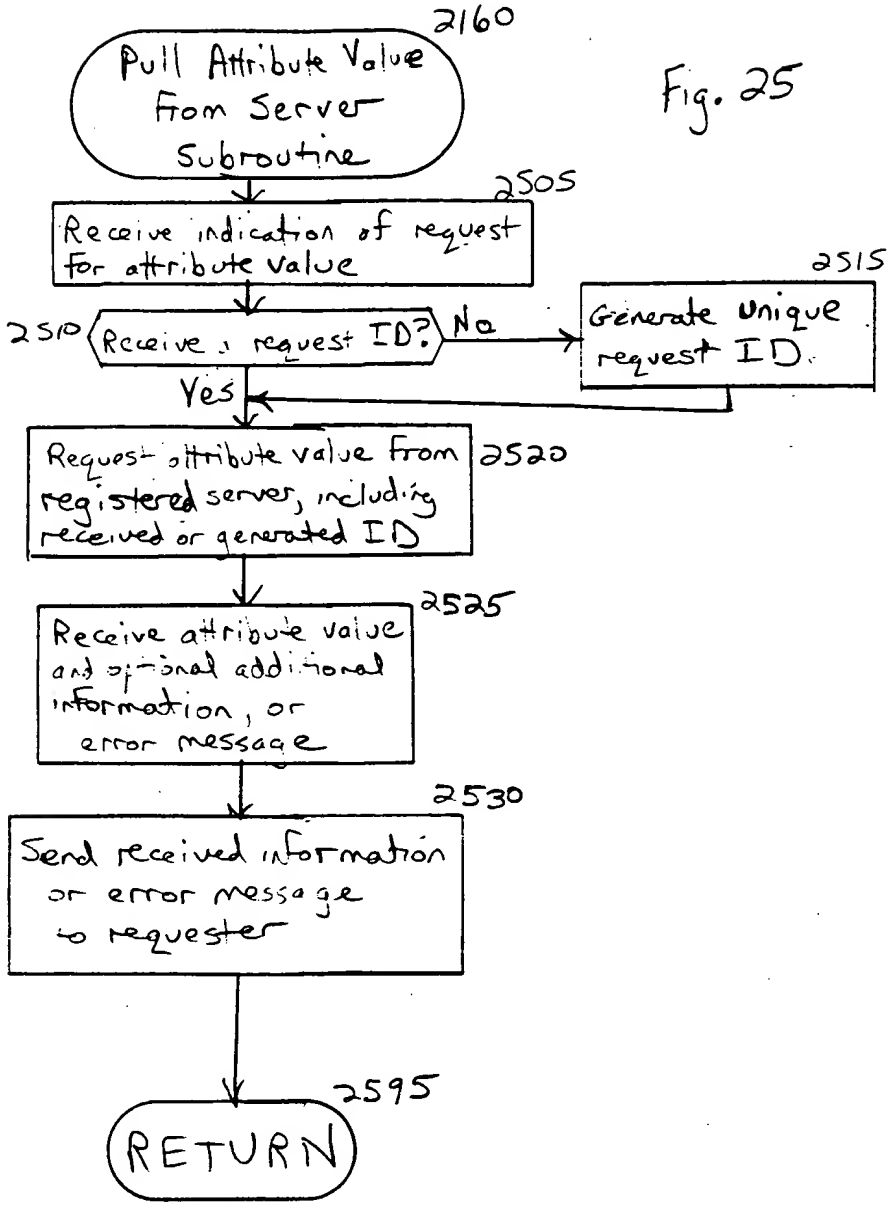

2160
Pull Attribute Value From Server Subroutine
2505
Receive indication of request for attribute value
2510
Receive a request ID?
No
2515
Generate unique request ID.
Yes
Request attribute value from registered server, including received or generated ID
2520
2525
Receive attribute value and optional additional information, or error message
2530
Send received information or error message to requester
2595
RETURN

Fig. 25

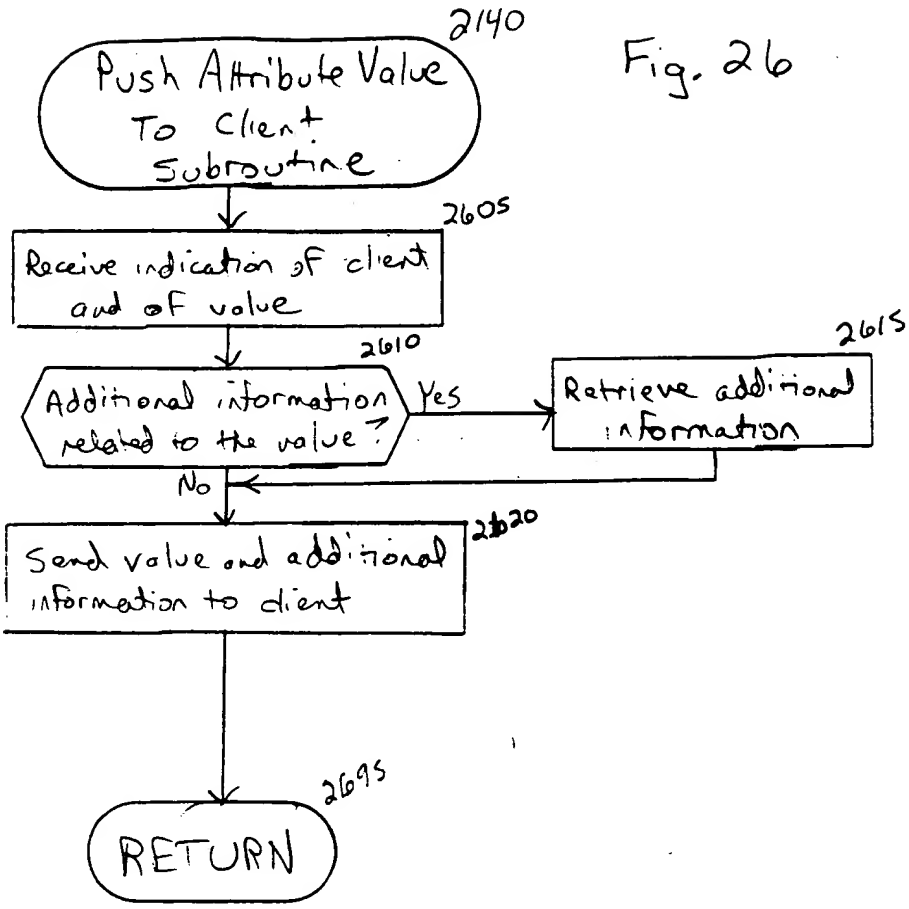

2140
Push Attribute Value To Client Subroutine
2605
Receive indication of client and of value
2610
Additional information related to the value?
Yes
2615
Retrieve additional information
No
2620
Send value and additional information to client
2695
RETURN

Fig. 26

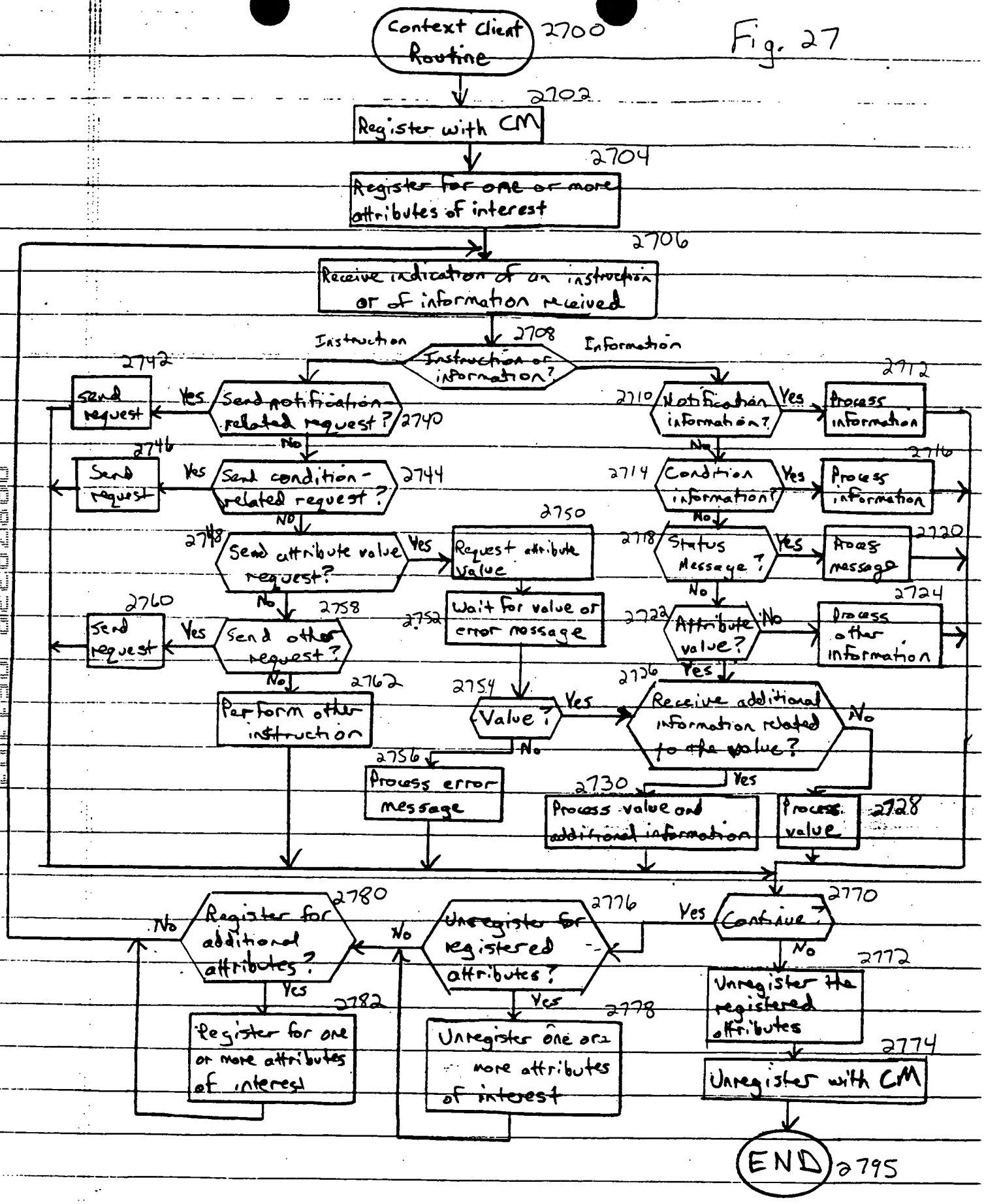
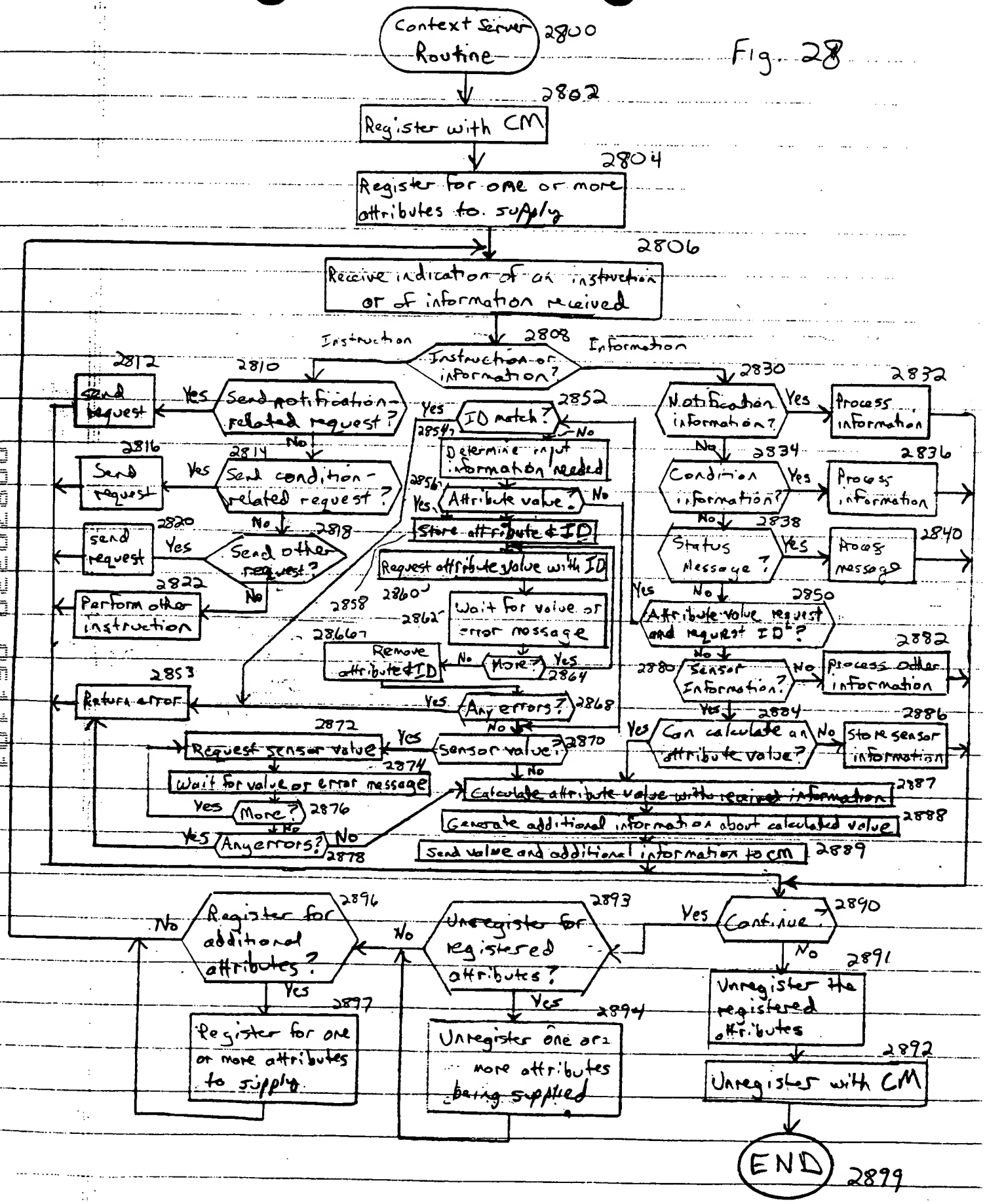

Context Client Routine
2700
Register with CM
2702
Register for one or more attributes of interest
2704
Receive indication of an instruction or of information received
2706
Instruction
Information
Instruction or information?
2708
Send request
2742
Yes
Send notification-related request?
2740
No
Send request
2746
Yes
Send condition-related request?
2744
No
Send attribute value request?
2748
Yes
Request attribute value
2750
No
Send request
2760
Yes
Send other request?
2758
No
Perform other instruction
2762
Wait for value or error message
2752
Value?
2754
Yes
No
Process error message
2756
Notification information?
2710
Yes
Process information
2712
No
Condition information?
2714
Yes
Process information
2716
No
Status Message?
2718
Yes
Process message
2720
No
Attribute value?
2722
No
Process other information
2724
Yes
Receive additional information related to the value?
2726
No
Yes
Process value and additional information
2730
Process value
2728
Continue?
2770
Yes
No
Unregister the registered attributes
2772
Unregister with CM
2774
END
2795
Unregister for registered attributes?
2776
No
Yes
Unregister one or more attributes of interest
2778
Register for additional attributes?
2780
No
Yes
Register for one or more attributes of interest
2782

Fig. 28


Context Server Routine
2800
2802
Register with CM
2804
Register for one or more attributes to supply
2806
Receive indication of an instruction or of information received
2808
Instruction or information?
Instruction
Information
2810
Send notification-related request?
Yes
2812
Send request
No
2814
Send condition-related request?
Yes
2816
Send request
No
2818
Send other request?
Yes
2820
Send request
No
2822
Perform other instruction
2852
ID match?
Yes
No
2854
Determine input information needed
2856
Attribute value?
Yes
No
Store attribute & ID
Request attribute value with ID
2858
2860
Wait for value or error message
2862
More?
Yes
No
2864
Remove attribute & ID
2866
Any errors?
Yes
2868
No
2853
Return error
2870
Sensor value?
Yes
2872
Request sensor value
2874
Wait for value or error message
More?
Yes
2876
No
Any errors?
Yes
2878
No
2830
Notification information?
Yes
2832
Process information
No
2834
Condition information?
Yes
2836
Process information
No
2838
Status message?
Yes
2840
Process message
No
2850
Attribute value request and request ID?
Yes
No
2880
Sensor information?
Yes
No
2882
Process other information
2884
Can calculate an attribute value?
Yes
No
2886
Store sensor information
2887
Calculate attribute value with received information
2888
Generate additional information about calculated value
2889
Send value and additional information to CM
2890
Continue?
Yes
No
2891
Unregister the registered attributes
2892
Unregister with CM
END
2899
2893
Unregister for registered attributes?
No
Yes
2894
Unregister one or more attributes being supplied
2896
Register for additional attributes?
No
Yes
2897
Register for one or more attributes to supply